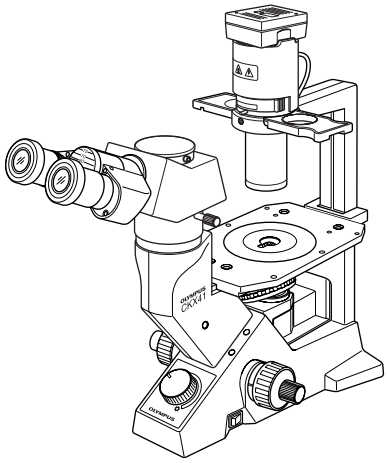
OLYMPUS®



INSTRUCTIONS

CKX41/CKX31

CULTURE MICROSCOPES

This instruction manual is for the Olympus Culture Microscopes Models CKX41 and CKX31. To ensure the safety, obtain optimum performance and to familiarize yourself fully with the use of this microscope, we recommend that you study this manual thoroughly before operating the microscope. Retain this instruction manual in an easily accessible place near the work desk for future reference.

AX7351

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IMPORTANT

The difference between the CKX31 and CKX41 microscopes lie in the following basis systems.

	CKX31	CKX41
Observation tube	Binocular tube fixed	Replaceable*
Stage center plate	–	Replaceable**
Reflected fluorescence system	Not mountable	Mountable

* The U-CBI30-2/U-BI30-2/U-CTBI/CKX-TBI binocular tube or U-CTR30-2/U-TR30-2 trinocular tube can be mounted. But no intermediate attachment can be mounted.

**The standard stage center plate can be replaced with the CK40-CPG glass center plate, IX-CP50 center plate (50 mm), etc.

⚠ SAFETY PRECAUTIONS

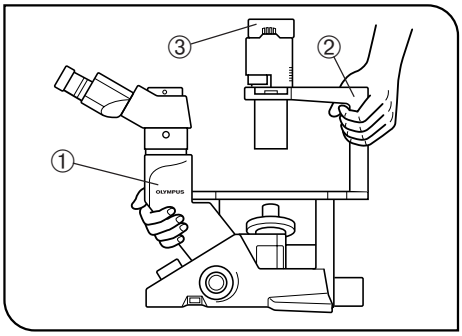


Fig. 1

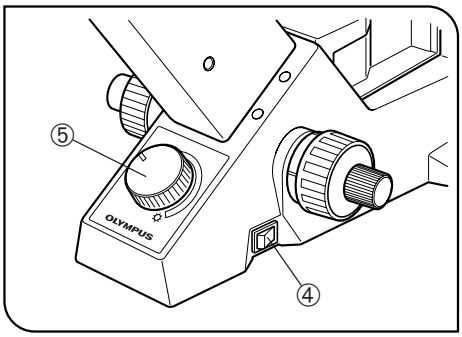


Fig. 2

1. After the equipment has been used in an observation of a specimen that is accompanied with a potential of infection, clean the parts coming in contact with the specimen to prevent infection.
   - Moving this product is accompanied with the risk of dropping the specimen. Be sure to remove the specimen before moving this product.
   - In case the specimen is damaged by erroneous operation, promptly take the infection prevention measures.
2. Install the microscope on a sturdy, level table or bench (Weight: CKX31 about 8 kg, CKX41 about 8.8 kg).
3. When transporting the microscope, be sure to keep it horizontal by holding it by the root of the observation tube relay tube ① and the illumination column ②. (Fig. 1)
   Be sure to remove the specimen since it may fall.

★ **Do not tilt it during carrying to prevent damaging the desktop or microscope.**

4. Culture liquid or water spilt on the stage, objective or microscope frame may damage the equipment. Immediately disconnect the power cord from the wall outlet and wipe the liquid or water off if it is spilt on them.
5. The surfaces of the lamp socket ③ of the illumination column will become extremely hot during operation. When installing the microscope, make sure to allow ample free space around and in particular above the lamp socket. (Fig. 1)
   When using the TV camera or photomicrographic system, install them so that the connection cable does not come in contact with the lamp socket.
6. To avoid potential shock hazards and burns when replacing the light bulb, set the main switch ④ to "O" (OFF) then disconnect the power cord from the wall outlet in advance. Whenever you replace the bulb during use or right after use, allow the lamp socket ③ and bulb to cool before touching. (Figs. 1 & 2)

Designated bulbs:	6V30WHAL high-intensity halogen bulb (PHILIPS 5761)

7. Always use the power cord provided by Olympus. If no power cord is provided, please select the proper power cord by referring to the section "PROPER SELECTION OF THE POWER SUPPLY CORD" at the end of this instruction manual. If the proper power cord is not used, product safety performance cannot be warranted.
8. Always ensure that the **grounding terminal** of the microscope and that of the wall outlet are properly connected. If the equipment is not grounded, Olympus can no longer warrant the electrical safety performance of the equipment.

9. The microscope system is unstable when the large camera back is attached. When pulling out the film, be sure to hold the microscope with one hand.
10. Always turn the light intensity control knob ⑤ gently. Do not attempt to turn it beyond the stop position. (Fig. 2)

Safety Symbols

The following symbols are found on the microscope. Study the meaning of the symbols and always use the equipment in the safest possible manner.

Symbol	Explanation
	Indicates that the surface becomes hot, and should not be touched with bare hands.
	Before use, carefully read the instruction manual. Improper use could result in personal injury to the user and/or damage to the equipment.
I	Indicates that the main switch is ON.
O	Indicates that the main switch is OFF.

Warnings

Warning engraving is placed at parts where special precaution is required when handling and using the microscope. Always heed the warnings.

Warning engraving position	**Lamp socket (U-LS30-3)** **[Warning against high temperature]**

1 Getting Ready

1. A microscope is a precision instrument. Handle it with care and avoid subjecting it to sudden or severe impact.
2. Do not use the microscope where it is subjected to direct sunlight, high temperature and humidity, dust or vibrations. (For the operating conditions, see chapter 8, “SPECIFICATIONS”.)
3. Use the tension adjustment ring to adjust the rotation tension of the coarse adjustment knob.
4. For the applicable objectives, see chapter 8, “SPECIFICATIONS”. Olympus cannot guarantee the performance when other objective than specified is used.

2 Maintenance and Storage

1. Clean all glass components by wiping gently with gauze. To remove fingerprints or oil smudges, wipe with gauze slightly moistened with a mixture of ether (70%) and alcohol (30%).

⚠**Since solvents such as ether and alcohol are highly flammable, they must be handled carefully. Be sure to keep these chemicals away from open flames or potential sources of electrical sparks — for example, electrical equipment that is being switched on or off. Also remember to always use these chemicals only in a well-ventilated room.**

2. Do not attempt to use organic solvents to clean the microscope components other than the glass components. To clean them, use a lint-free, soft cloth slightly moistened with a diluted neutral detergent.
3. Be careful not to spill any liquid — such as a culture solution — on the unit. If you do spill anything, immediately set the main switch to "O" (OFF) and unplug the power cord. Then wipe away any liquid on or under the objectives.
4. If no objectives are mounted, be sure to cover the objective mounting threaded positions on the revolving nosepiece to prevent and dust and spilled culture solution from getting on the lenses inside.
5. Do not disassemble any part of the microscope as this could result in malfunction or reduced performance.
6. When not using the microscope, keep it covered with a dust cover. Make sure the lamp socket is cool before covering the microscope.
7. Using a device that radiates ultraviolet light such as a germicidal lamp near the microscope may discolor (yellow) parts of the microscope surface. The amount of discoloration depends on the radiation intensity of the ultraviolet light and the distance between the microscope and radiation source. When not using the microscope, cover it with the dust cover. We recommend that you also cover the microscope with an impermeable sheet.

3 Caution

If the microscope is used in a manner not specified by this manual, the safety of the user may be imperiled. In addition, the equipment may also be damaged. Always use the equipment as outlined in this instruction manual.

The following symbols are used to set off text in this instruction manual.

⚠ : Indicates that failure to follow the instructions in the warning could result in bodily harm to the user and/or damage to equipment (including objects in the vicinity of the equipment).

★ : Indicates that failure to follow the instructions could result in damage to equipment.

◎ : Indicates commentary (for ease of operation and maintenance).

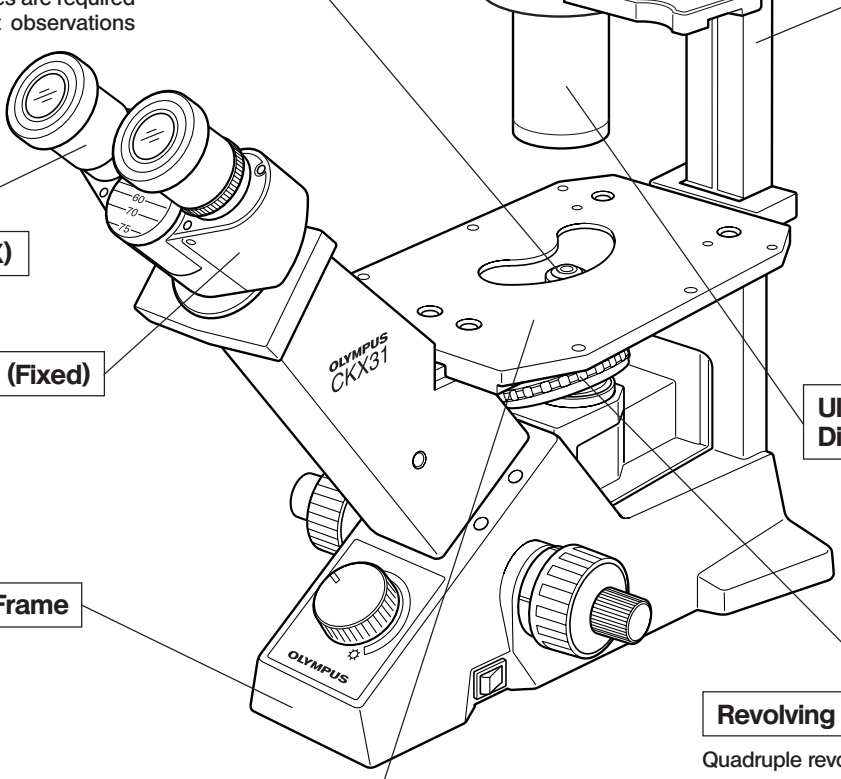
This device complies with the requirements of directive 98/79/EC concerning in vitro diagnostic medical devices. CE marking means the conformity to the directive.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1 NOMENCLATURE

CKX31



Phase Contrast Slider

- Pre-centered Ph slider: IX2-SLP
- Ph centering slider: IX2-SL

Lamp Socket

U-LS30-3

Objectives

For brightfield observation:
PlanCN 4X
PlanCN 10X
PlanCN 20X
PlanCN 40X
PlanCN 60X
PlanCN 100XO

★Dedicated objectives are required for phase contrast observations (see page 17).

Illumination Column (Fixed)

Eyepieces (10X)

Binocular Tube (Fixed)

Ultralong Working Distance Condenser

Microscope Frame

- CKX31SF

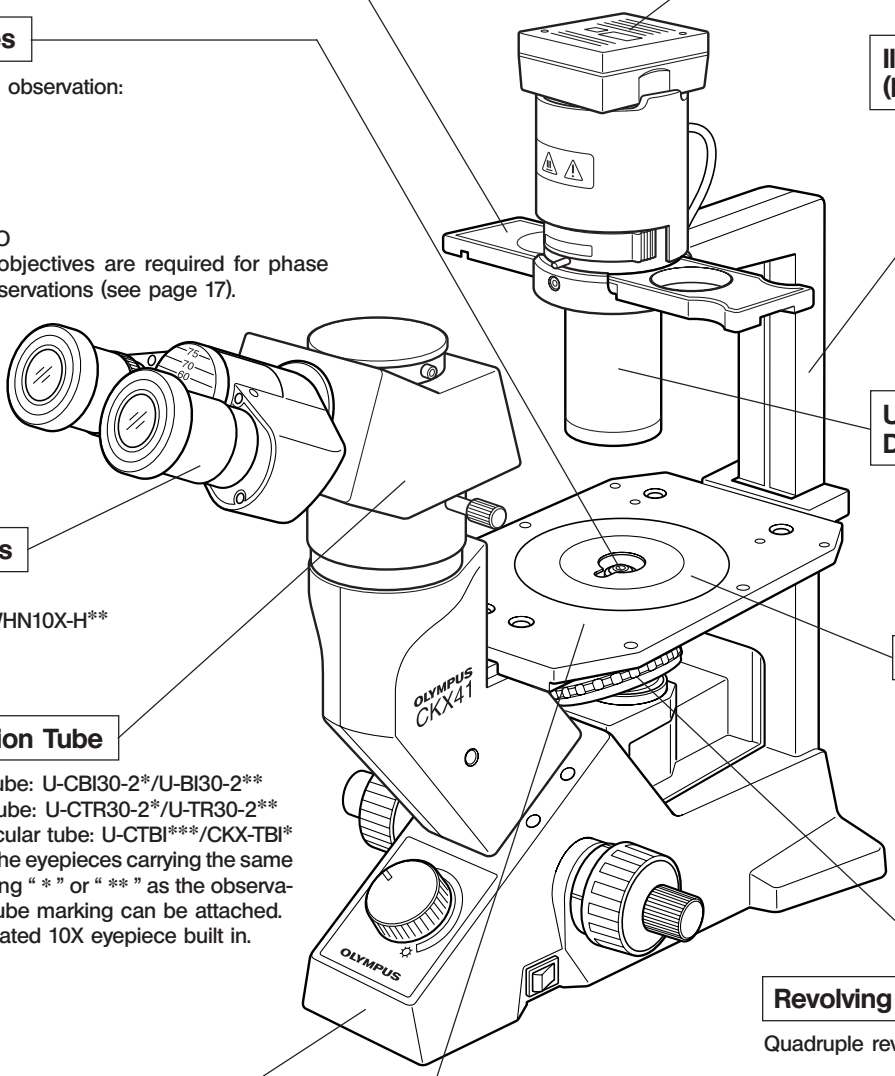
Revolving Nosepiece (Fixed)

Quadruple revolving nosepiece

Stage (Fixed)

- Stage extension plate: CK2-SS
- Mechanical stage: CK40-MVR

CKX41



Phase Contrast Slider

- Pre-centered Ph slider: IX2-SLP
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Lamp Socket

U-LS30-3

Objectives

For brightfield observation:
PlanCN 4X
PlanCN 10X
PlanCN 20X
PlanCN 40X
PlanCN 60X
PlanCN 100XO
★Dedicated objectives are required for phase contrast observations (see page 17).

Illumination Column (Fixed)

Ultralong Working Distance Condenser

Eyepieces

- WHB10X*
- WHN10X/WHN10X-H**

Observation Tube

- Binocular tube: U-CBI30-2*/U-BI30-2**
- Trinocular tube: U-CTR30-2*/U-TR30-2**
- Tilting binocular tube: U-CTBI***/CKX-TBI*

*/** Only the eyepieces carrying the same marking " * " or " ** " as the observation tube marking can be attached.
*** Dedicated 10X eyepiece built in.

Stage Center Plate

- Standard stage center plate
- Glass stage center plate: CK-40CPG
- Stage center plate (50 mm): IX-CP50

Revolving Nosepiece (Fixed)

Quadruple revolving nosepiece

Microscope Frame

CKX41SF

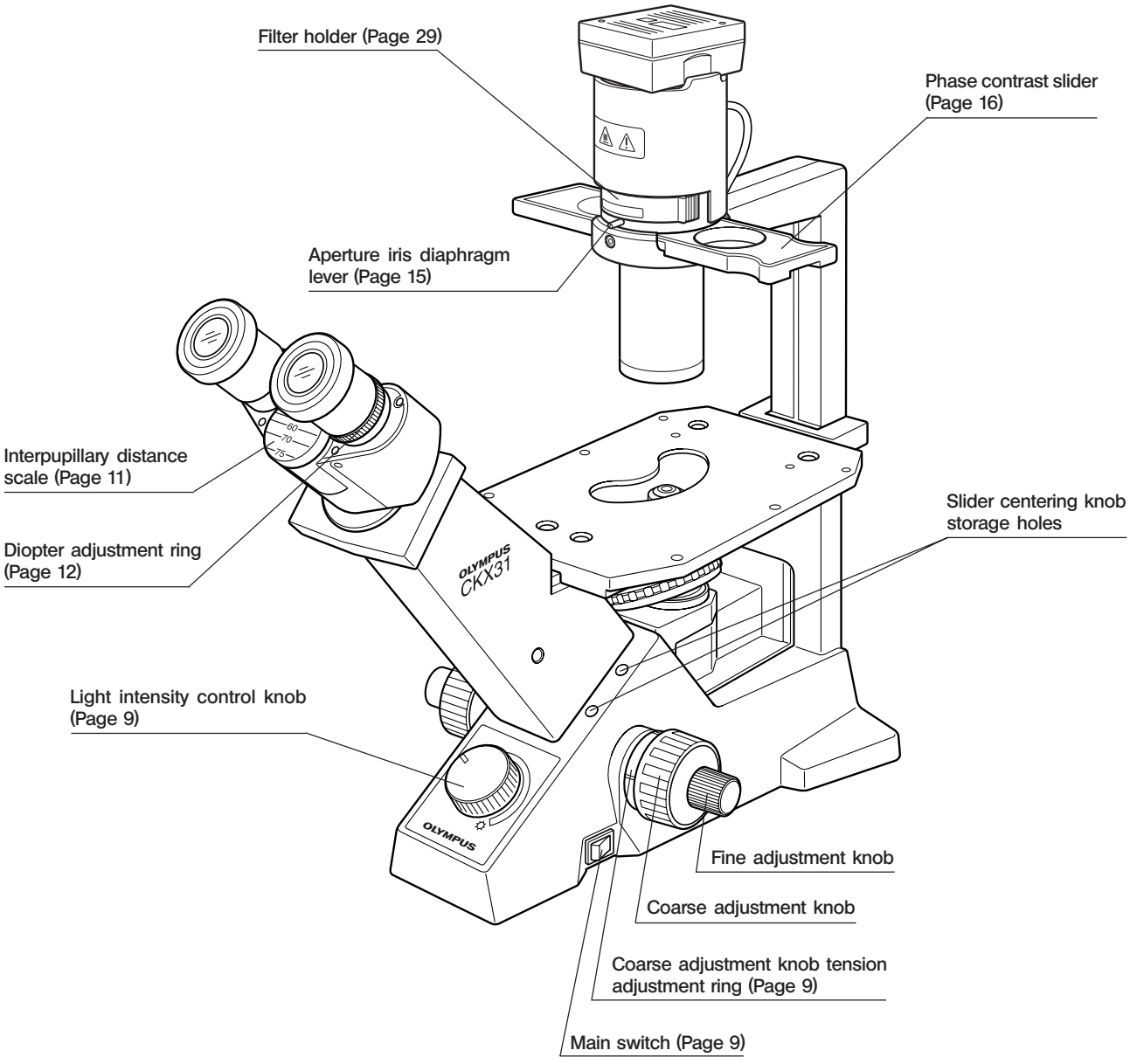
Stage (Fixed)

- Stage extension plate: CK2-SS
- Mechanical stage: CK40-MVR

2 CONTROLS

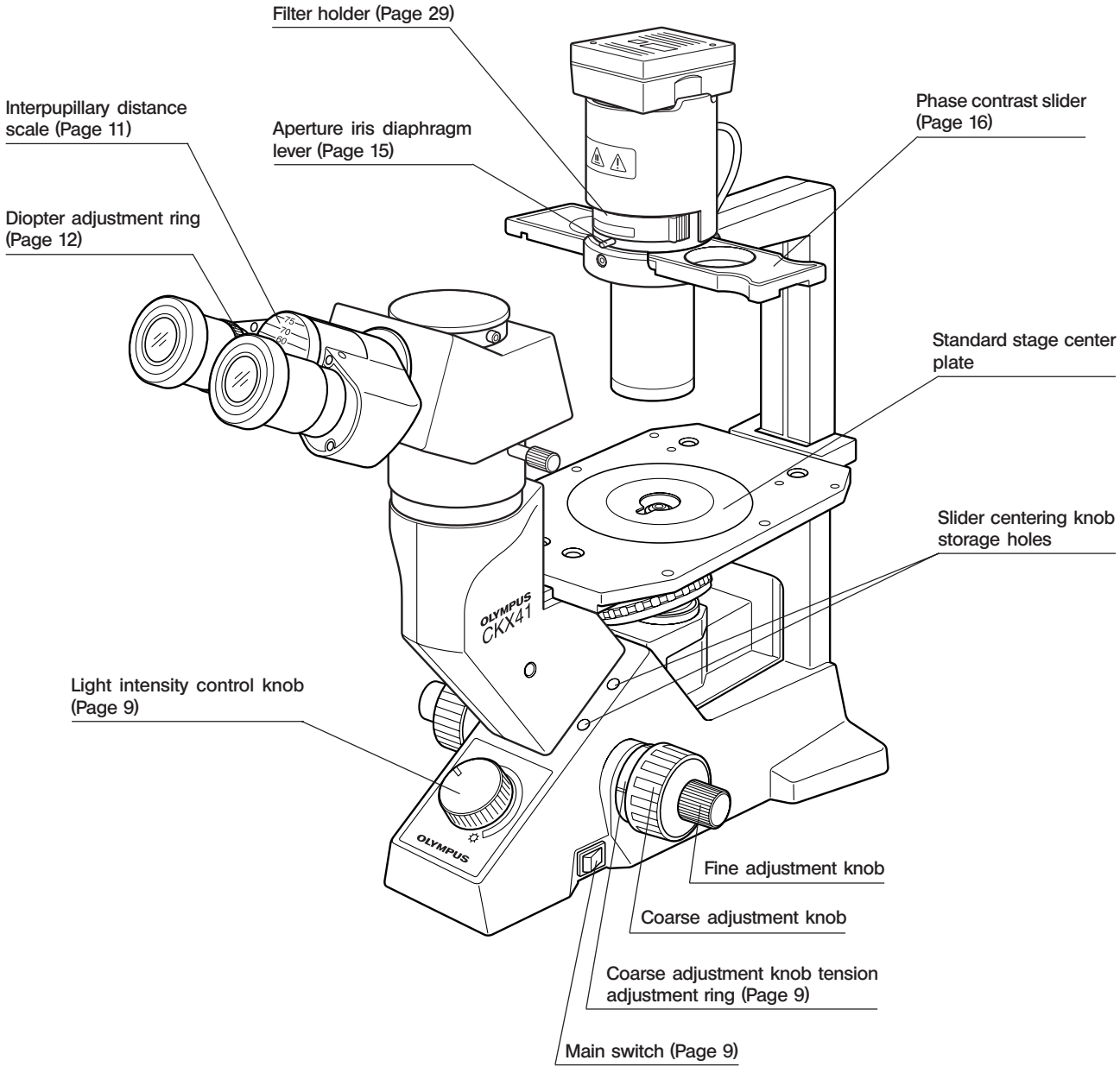
CKX31

◎If you have not yet assembled the microscope, read chapter 9, "ASSEMBLY" (pages 25 to 29).

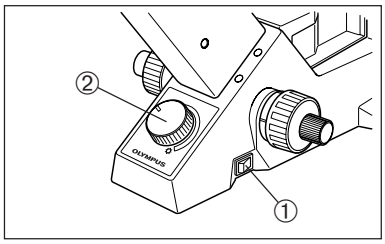

Filter holder (Page 29)
Phase contrast slider (Page 16)
Aperture iris diaphragm lever (Page 15)
Interpupillary distance scale (Page 11)
Diopter adjustment ring (Page 12)
Slider centering knob storage holes
Light intensity control knob (Page 9)
Fine adjustment knob
Coarse adjustment knob
Coarse adjustment knob tension adjustment ring (Page 9)
Main switch (Page 9)
OLYMPUS
CKX31

CKX41

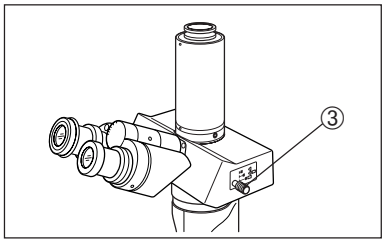
◎If you have not yet assembled the microscope, read chapter 9, "ASSEMBLY" (pages 25 to 29).


Filter holder (Page 29)
Interpupillary distance scale (Page 11)
Aperture iris diaphragm lever (Page 15)
Phase contrast slider (Page 16)
Diopter adjustment ring (Page 12)
Standard stage center plate
Slider centering knob storage holes
Light intensity control knob (Page 9)
Fine adjustment knob
Coarse adjustment knob
Coarse adjustment knob tension adjustment ring (Page 9)
Main switch (Page 9)
OLYMPUS
CKX41
OLYMPUS

3 SUMMARY OF OBSERVATION PROCEDURE

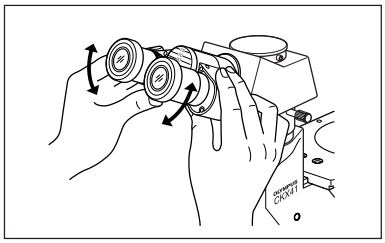


1. Set the main switch ① to "**I**" (ON) and turn the light intensity control knob ② to obtain appropriate brightness. (Page 9)

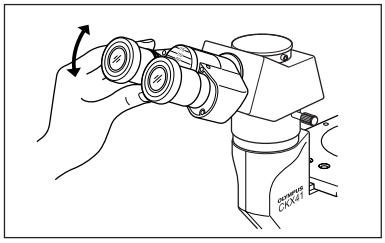


2. When using the U-TR30-2 trinocular tube, push in the light path selector knob ③ to set the light path at 100% for binocular observation. (Page 14)

3. Place a specimen on the stage. (Page 10)
4. Turn the revolving nosepiece to bring the 10X objective into the light path. Be sure to turn the revolving nosepiece until it clicks.



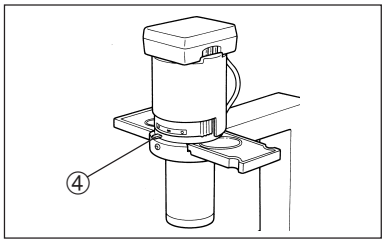
5. Adjust the interpupillary distance of the eyepieces. (Page 11)



6. Adjust the diopter of the eyepieces. (Page 12)

7. Bring the required objective into the light path and focus on the specimen.
8. When using the 40X objective provided with the correction collar, set the scale on the correction collar according to the thickness of the vessel bottom. (Page 16)

◎When performing phase contrast observation, see pages 17 and after.



9. When observing an undyed specimen with brightfield, stop down the aperture iris diaphragm ④. In phase contrast observation, set the aperture wide open. (Page 15)
   Bring the required filter into the light path. (Page 15)
10. In brightfield observation, use the LBD filter. In phase contrast observation, use the IF550 green filter as required.

◎In photomicrography, it is recommended to use the 45HA heat absorbing filter.

4 USING THE CONTROLS

4-1 Microscope Frame

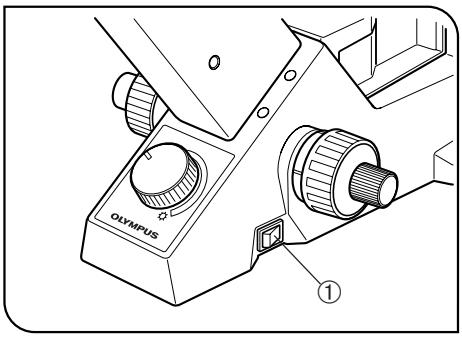


Fig. 3

1 Turning On the Light Source (Fig. 3)

Set the main switch ① on the side panel of the microscope frame to " I " (ON).

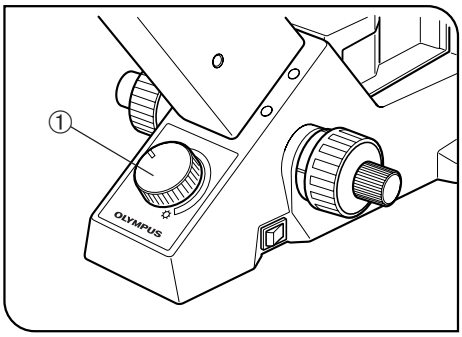


Fig. 4

2 Adjusting the Brightness (Fig. 4)

Turn the light intensity control ① clockwise to raise the voltage and increase the brightness. Turn it counterclockwise to lower the voltage and decrease the brightness.

◎The service life of the bulb can be extended by using the bulb at a lower voltage.

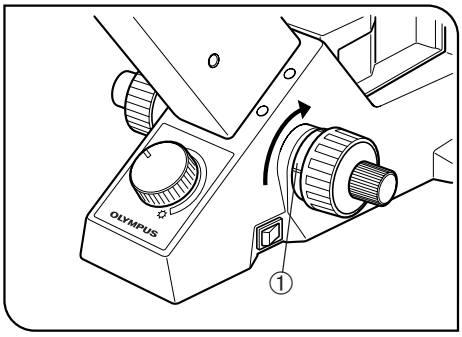


Fig. 5

3 Adjusting the Tension of the Coarse Adjustment Knob (Fig. 5)

★Be sure to use the tension adjustment ring ① to adjust the rotation tension of the coarse adjustment knob.

Adjustment Procedure

Turn the tension adjustment ring ① with your fingers or using a flat-blade screwdriver. When the ring is turned in the direction of the arrow, tension of the coarse adjustment knob increases. Turning the ring in the opposite direction decreases the tension.

If the revolving nosepiece descends on its own or if the specimen gets out of focus quickly even when it is brought into focus using the fine adjustment knob, it means that the tension of the coarse adjustment knob is too low. Turn the ring in the direction of the arrow to increase the tension.

4-2 Stage

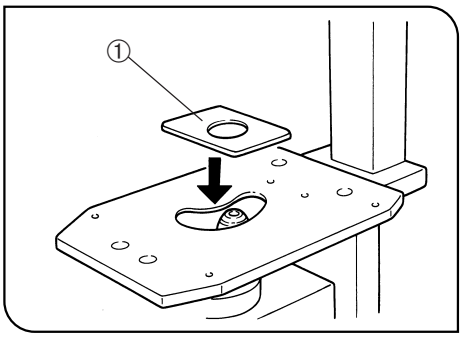


Fig. 6

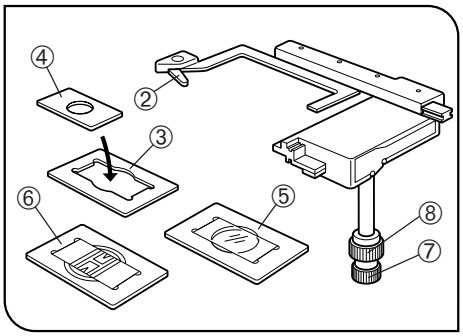


Fig. 7

1 Placing the Specimen (Figs. 6 & 7)

Put the specimen in the center of the stage.

When Using a φ35 mm Petri Dish

◎With the CKX41, a 35 mm petri dish can be mounted directly on the stage provided that the standard stage center plate is in use.

1. With the CKX31, put the provided 35 mm petri dish holder ① on the stage and mount the 35 mm petri dish on the opening in the center.
2. To move the petri dish, slide the entire holder.

Using the Mechanical Stage

1. When using a 96-well or 24-well micro-titer plate, extend the specimen holder ② to directly hold the micro-titer plate. (Fig. 7)
2. To hold any other type of plate, combine one of the following provided holders with the mechanical stage.
   - Terasaki holder ③ (AB4488): For Terasaki plate, 35 mm petri dish holder ④ or 65 mm petri dish.
   - Slide glass holder ⑤ (AB4489): For slide glass, 54 mm petri dish.
   - Blood cell test plate holder IX2-BCTP ⑥ (optional):For a blood cell test plate holder or other calculating chamber for bacteria and eosinophil with mounting section dimensions corresponding to $H\,77^{+0.3}_{0} \times V\,35^{+0.3}_{0} \times D\,2$ mm, or for a 60mm petri dish.
3. The specimen can be moved to the desired position by turning the X-axis knob ⑦ and Y-axis knob ⑧ (Stroke: 120 mm in X-axis direction, 78 mm in Y-axis direction).

2 Moving the Specimen

Turn the X-axis and Y-axis knobs of the mechanical stage or move the specimen directly by hand.

★**Be careful when changing objectives. When objectives are switched after observing the specimen with an objective with short working distance, the newly selected objective may interfere with the stage center plate or petri dish holder.**

◎With the CKX41, the IX-CP50 stage center plate (φ50 mm) allows a wide range of use without interference.

4-3 Observation Tube

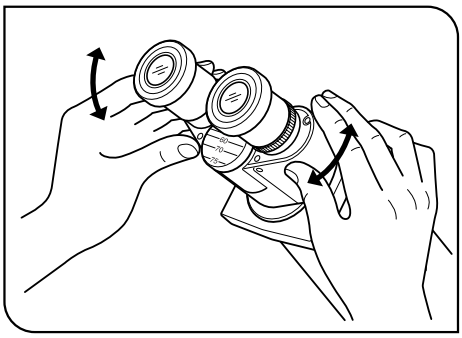


Fig. 8

1 Adjusting the Interpupillary Distance (Figs. 8 to 10)

⚠When adjusting the interpupillary distance, take care not to let your fingers get caught in the gaps of the binocular section.

With the CKX31

While looking through the eyepieces, move both eyepieces until the left and right fields of view coincide completely.
Adjust so that the two index dots • ① are horizontal. (Fig. 9)

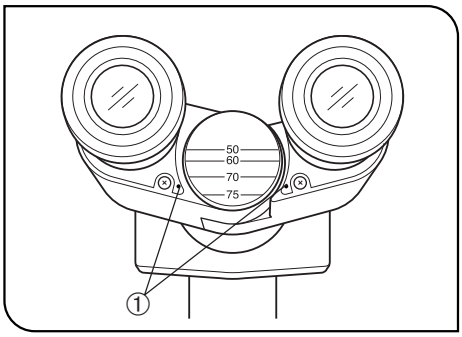


Fig. 9

◎To make the line connecting the two index dots horizontal, adjust so that the index dots come on the extension of one of the horizontality lines inscribed on the pivot.
When your interpupillary distance is other than 50, 60, 70 and 75, adjust so that the line connecting the two index dots are in parallel with the horizontality lines on the pivot. (Fig. 9)
◎Note your interpupillary distance so that it can be quickly duplicated.

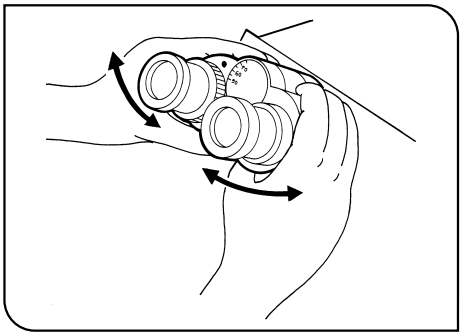


Fig. 10

With the CKX41

◎When the observation tube is the U-CBI30-2, U-CTR30-2 or U-CTBI, follow the procedure in "With the CKX31".
◎When the observation tube is the U-BI30-2, U-TR30-2 or CKX-TBI only one index dot is provided. (Fig. 10)
• While looking through the eyepieces, move both eyepieces until the left and right fields of view coincide completely. The position of index dot • indicates the interpupillary distance.
◎Note your interpupillary distance so that it can be quickly duplicated.

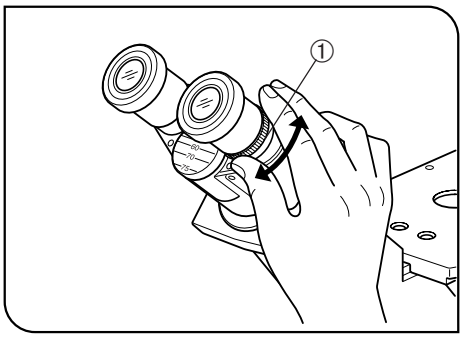


Fig. 11

2 Adjusting the Diopter (Figs. 11 to 13)

With the CKX31

1. While looking through the left eyepiece with your left eye, turn the coarse and fine focus adjustment knobs to bring the specimen into focus.
2. While looking through the right eyepiece with your right eye, turn only the diopter adjustment ring ① to focus on the specimen. (Fig. 11)

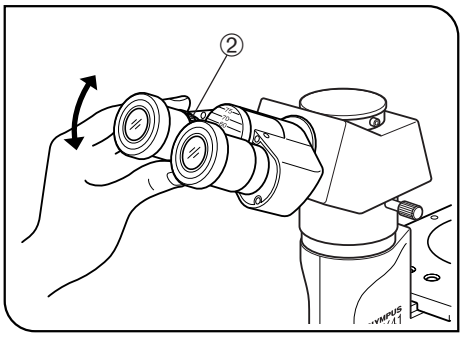


Fig. 12

With the CKX41

◎When the U-CTBI is used, align the white dot • with the index line on the scale of the right eyepiece's diopter adjustment ring.

1. While looking through the right eyepiece with your right eye, turn the coarse and fine focus adjustment knobs to bring the specimen into focus.
2. While looking through the left eyepiece with your left eye, turn only the diopter adjustment ring ② to focus on the specimen. (Fig. 12)

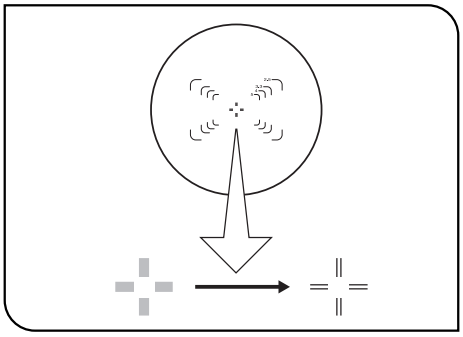


Fig. 13

Using a Finder Eyepiece

◎Insert the finder eyepiece into the right eyepiece sleeve of the U-TR30-2 trinocular tube.

1. Looking through the right eyepiece with your right eye, turn the eyepiece top ring until clearly defined double crosslines can be seen in the field of view. (Fig. 13)
2. Looking through the right eyepiece, turn the coarse and fine adjustment knobs to bring the specimen and double crosslines into simultaneous focus.
3. Looking through the left eyepiece with your left eye, turn the diopter adjustment ring to focus on the specimen.

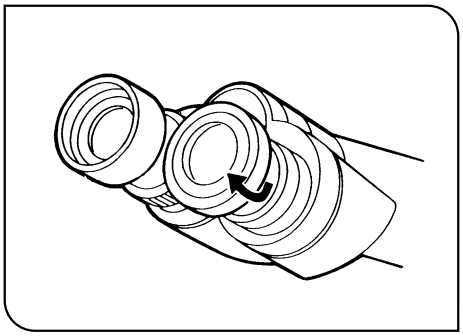


Fig. 14

3 Using the Eye Shades (Fig. 14)

When Wearing Eyeglasses

Use with the eyeshades in the normal, folded-down position. This will prevent the eyeglasses from being scratched.

When Not Wearing Eyeglasses

Extend the folded eyeshades in the direction of the arrow to prevent extraneous light from entering between the eyepieces and eyes.

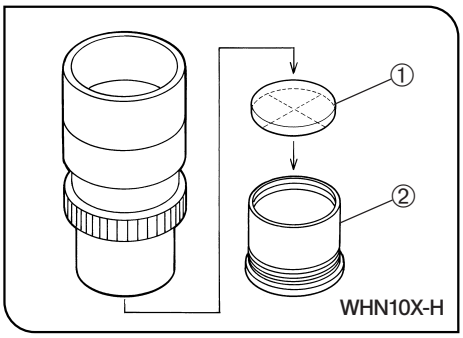


Fig. 15-1

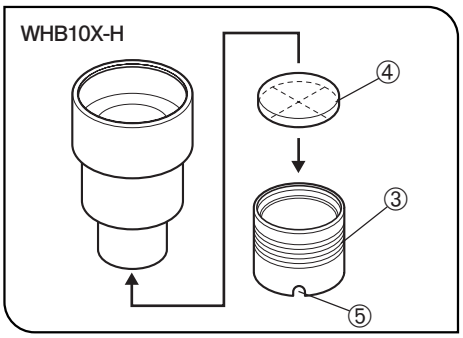


Fig. 15-2

4 Using the Eyepiece Micrometer Disk (Figs. 15)

◎When the WHN10X-H (or WHN10X) eyepieces are used, an eyepiece micrometer disk can be inserted in one of them. When the eyepiece does not have a diopter adjustment mechanism, however, it is hard to focus on the micrometer disk if the operator has poor eyesight. Should that be the case, adjust the focus with eyeglasses on.

Use an eyepiece micrometer disk with a diameter of ϕ24 mm and thickness of 1.5 mm.

Following Fig. 15-1, turn the built-in micrometer-mounting frame ② counterclockwise to remove it from the eyepiece and place a micrometer disk ① into the mounting frame. The engraving on the eyepiece micrometer disk should face downward in the micrometer-mounting frame.

Screw the micrometer-mounting frame back into the eyepiece.

◎When the WHB10X-H (or WHB10X) eyepieces are used, an eyepiece micrometer disk with a diameter of ϕ20.4 mm and thickness of 1 mm can be inserted in one of them using the 20.4RH reticle holders ③ (2-piece set). When the eyepiece does not have a diopter adjustment mechanism, however, it is hard to focus on the micrometer disk if the operator has poor eyesight. Should that be the case, adjust the focus with eyeglasses on.

When the reticle holders are used, the field number becomes 19.6.

The field number of the U-CTBI's built-in eyepieces is 18, so it does not change.

1. Remove both eyepieces. (When the U-CTBI is used, remove only the right eyepiece by unscrewing the clamping screw on it with a precision flat-blade screwdriver.)
2. Place an eyepiece micrometer disk ④ in one of the reticle holders ③ so that the engraving on the eyepiece micrometer disk faces downward.
3. Screw the reticle holder ③ containing the eyepiece micrometer disk ④ into the bottom of the eyepiece.

   At the end of screwing, turn the reticle holder by hooking your nail on its notch ⑤ to screw it all the way in.
4. To provide the other eyepiece with the same field number, screw in the other reticle holder, without eyepiece micrometer disk, into the bottom of the other eyepiece.
5. Replace the eyepiece(s) in its(their) original position(s).

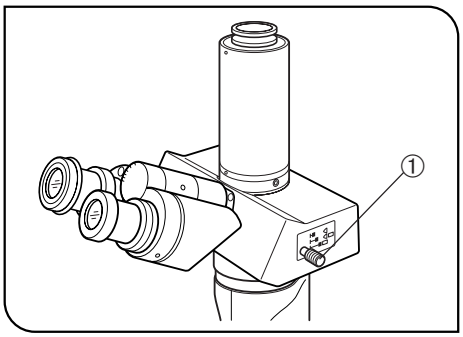
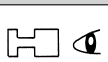
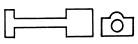


Fig. 16

5 Selecting the Light Path (U-TR30-2 Only) (Fig. 16)

Slide the light path selector knob ① to select the desired light path.

Light Path Selector Knob	Symbol	Intensity Ratio	Applications
Pushed in		100% for binocular eyepieces	Observation of dark specimens
Middle position		20% for binocular eyepieces, 80% for TV/photography	Observation of bright specimens, photography, TV observation
Pulled out		100% for TV/ photography	Photography, TV observation

★The U-CTR30-2 trinocular observation tube does not have the light path selector knob and its light intensity ratio is fixed at 50% binocular and 50% TV/photography.

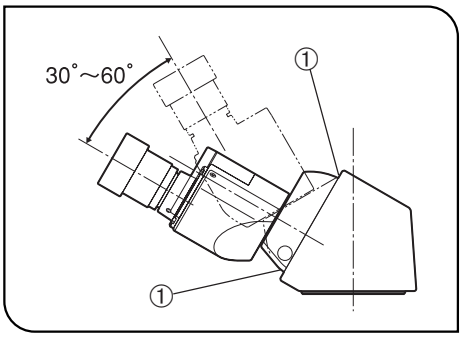


Fig. 17

6 Adjusting the Tilt (Fig. 17)

◎When using the U-CTBI or CKX-TBI, adjust the height and tilt of the observation tube to obtain the most comfortable viewing position.
Holding the binocular section with both hands, raise or lower it to the desired position.

- U-CTBI/CKX-TBI: 30 to 60°

★Never attempt to force the binocular section past the upper or lower stop position. Applying excessive force could destroy the limiting mechanism.

★The connectable eyepieces are the WHB10X only or the CXK-TBI and the built-in eyepieces (10X) for the U-TCBI. Combination with any other eyepiece will result in insufficient illumination at the periphery of the field of view.

⚠When adjusting the tilt of the U-CTBI, be careful not to have your fingers caught by the spaces ① between the binocular assembly and cover.

4-4 Illumination Column

1 Using the Filters

◎Using appropriate filters according to the purposes allows you to observe and photograph specimens more effectively. Particularly, the use of the LBD filter is recommended in observation and photomicrography because it renders more neutral colors.

◎More than one filter can be stacked in the filter holder (Filter diameter: 45 mm. Maximum thickness of stacked filters: 11 mm).

Filter	Application
45IF550-W45	Monochrome contrast filter (Green)
45ND6, 45ND25	Light intensity adjustment filter (Transmittance 6% and 25%)
45LBD2-N, 45KB	Color temperature conversion filter (For observation and photomicrography)
45HA (Heat absorbing filter)	Exposure time compensation in photomicrography

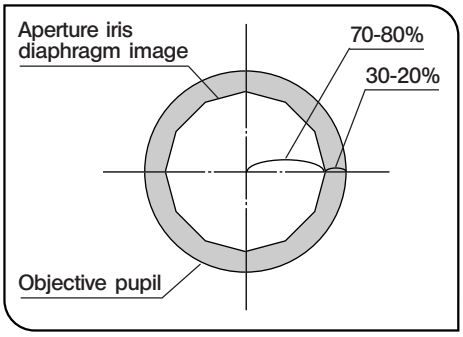


Fig. 18

2 Using the Aperture Iris Diaphragm (Fig. 18)

◎The aperture iris diaphragm determines the numerical aperture of the illumination system in brightfield observation. It enables you to adjust the depth of focus, contrast and resolution according to your requirements.

- Checking the aperture iris diaphragm:
  Remove the eyepiece when necessary (and insert the CT-5 or U-CT30 if you have one). Then look into the eyepiece sleeve; you will seen the field of view as shown in Fig. 18. Now adjust the aperture iris diaphragm lever as required.
- In general, when observing a dyed specimen, set the aperture iris diaphragm to 70% to 80% of the N.A. of the objective in use. However, when observing a culture specimen, which is not dyed, set the aperture iris diaphragm lever toward "".

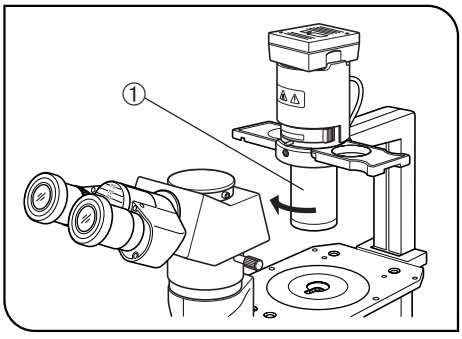


Fig. 19

3 Removing the Condenser Lens (Fig. 19)

◎To provide more working distance, turn the condenser's lower section ① in the direction of the arrow and remove it. When you do this, however, keep in mind that proper illumination cannot be achieved. Remove the condenser lens only when using a large culture vessel.

4-5 Objective Correction Collars

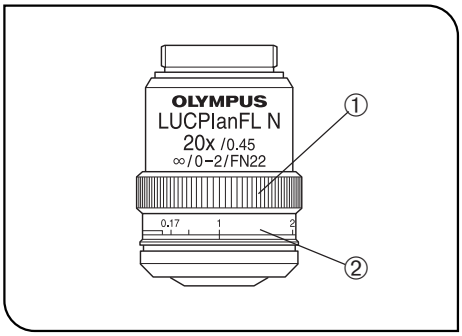


Fig. 20

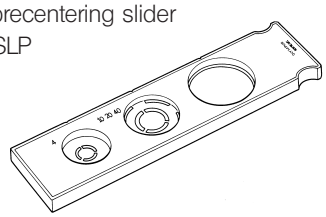
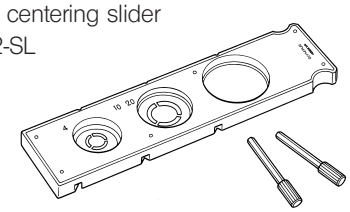
1 Correction Collar (Fig. 20)

◎A culture microscope is designed to observe specimens contained in vessels of various bottom thickness values. In order to achieve optimum objective performance of the culture microscope, the LUCPlanFLN20X, 40X, 60X, etc. are provided with a correction collar ①.
The correction is possible according to the vessel thickness.

1. If the thickness of the vessel bottom is known: Match the correction collar to the thickness of the vessel bottom using the collar scale ② provided.
2. If the thickness of the vessel bottom is unknown:
   The optimum position for the correction collar can be obtained from the image resolution. If a satisfactory sharp image is not obtained after focus adjustment, rotate the correction collar to the left and right so that you can compare the images at both sides. Reset the collar to the better image, then starting from this position, further rotate the collar to the left and right until both images can be obtained for comparison. By repeating this procedure several times, you will find best position for the correction collar. Refocus after rotating the correction collar.

5 PHASE CONTRAST OBSERVATION

The following two slider units are available for phase contrast observation. Mount a slider onto the microscope and replace the objectives with phase contrast compatible objectives.

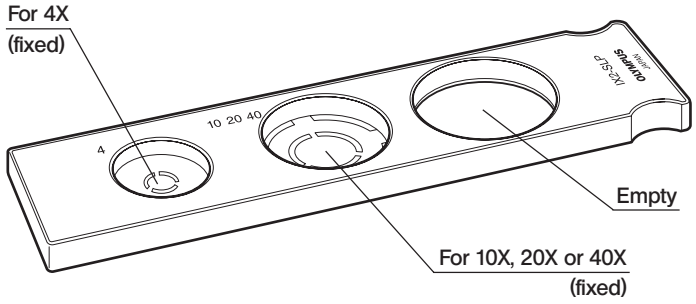
Model Name	Description	Applicable Objectives (Note)
Ph precentering slider IX2-SLP 	• The light annuli are precentered, so no adjustment is required. (For 4X, for 10X/20X/40X, and empty position) • The empty position can be used as a filter holder.	UPlanFLN4XPhP CAchN10XPhP LCAchN20XPhP LCAchN40XPhP
Ph centering slider IX2-SL 	• The light annulus has to be centered. (For PHL, for PHC/PH1, and for PH2/empty) • The empty position can be used as a filter holder.	UPlanFLN4XPh (PHL) CPlanN10XPh (PHC) LCAchN20XPh (PHC) PlanN10XPh (PH1) LUCPlanFLN 20XPh (PH1) LCAchN40XPh (PH2)

(Note) Only the four objectives listed can be used with the IX2-SLP. If other objective is used, the phase contrast effect cannot be obtained.

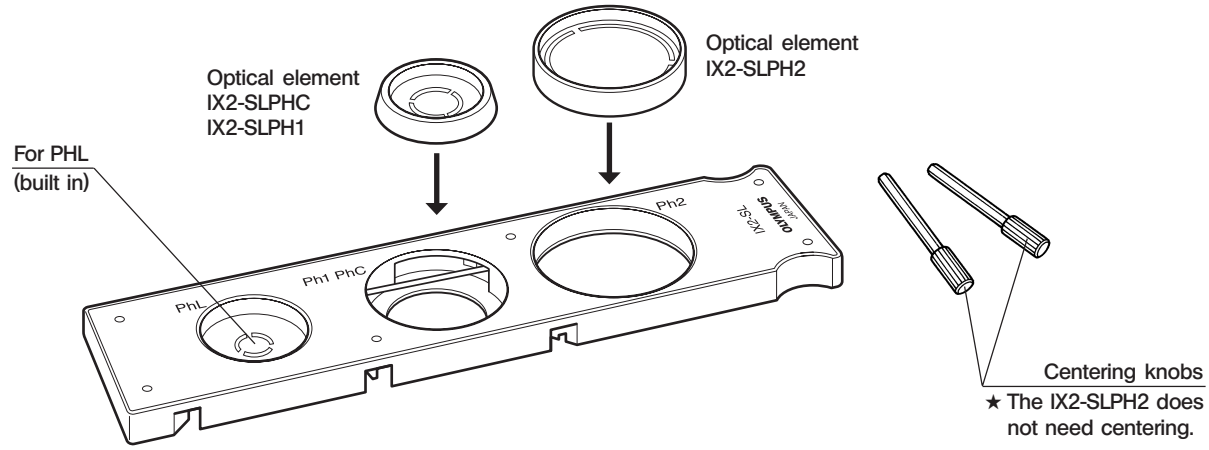
1 Names of Parts

Phase Sliders

Ph precentering slider IX2-SLP



Ph centering slider IX2-SL



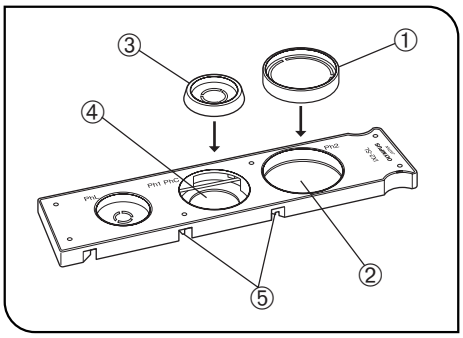


Fig. 21

2 Mounting the Optical Element (Fig. 21)

◎When the IX2-SL phase contrast slider is used, it is required to attach an optical element matching the phase objective in use.

1. Hold the IX2-SLPH2 optical element ① so that engraving faces upward and drop in the optical element in the empty position ②.
2. When mounting the IX2-SLPHC or IX2-SLPH1 optical element ③, insert the provided centering knobs into the screw holes ⑤, loosen them fully before dropping the optical element in the empty position ④ so that the engraving faces upward.
3. After dropping in the optical element, lightly tighten the centering knobs.

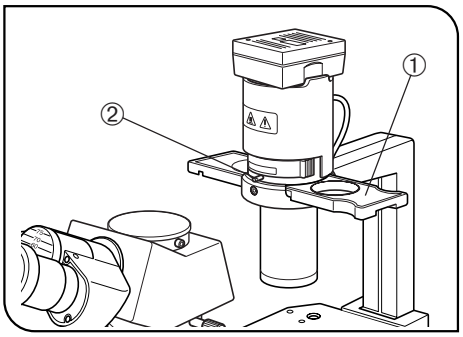


Fig. 22

3 Mounting the Phase Slider (Fig. 22)

1. Hold the phase slider ① face up (engraving side up) with the finger hold on the right, and insert it into the illumination column slot.
2. When performing phase contrast observation, always set the aperture iris diaphragm lever ② to "O" (wide open).

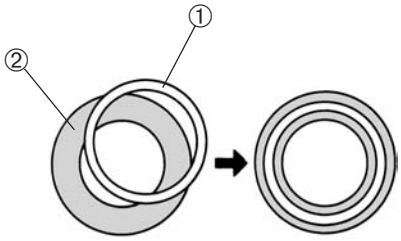


Fig. 23

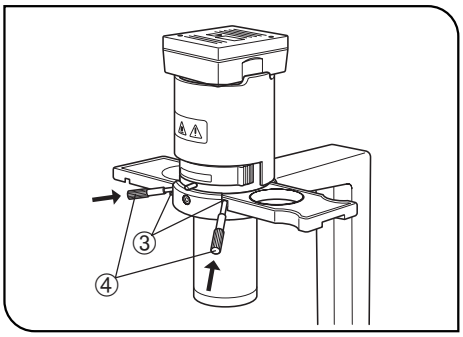


Fig. 24

4 Centering the Light Annulus (Figs. 23 & 24)

★**The IX2-SLP does not need to be centered. However, as the phase contrast effect near the vessel edge tends to drop because the light annulus image may be deformed due to the liquid surface curvature (surface tension). Use the center area of the light annulus whenever possible.**

1. Place a specimen on the stage and bring it into focus.
2. Replace the eyepiece in the sleeve which does not have a diopter adjustment ring with the CT-5 or U-CT30 centering telescope.
3. Make sure the magnification of the objective in the light path matches that of the light annulus on the phase slider.
4. While looking into the centering telescope, turn the knurled dial to focus on the phase annulus ② of the objective corresponding to the light annulus ①. (Fig. 24)
5. Insert the centering knobs ④ into the two centering screw holes ③ on the phase slider. Tighten and loosen the centering knobs until the light annulus is superimposed on the phase annulus ② of the objective. (Figs. 24 & 25)
6. Repeat the above steps to adjust centering with other objectives. However, the IX2-SL uses the PHC and PH1 light annulus with both the 10X and 20X objective. To ensure the use with both objectives, put the 10X or 20X objective that has not been used for centering into the light path and make absolutely sure the light annulus ① is not deviating from the phase annulus ②. If there is any deviation, perform the centering procedure with the other objectives again.

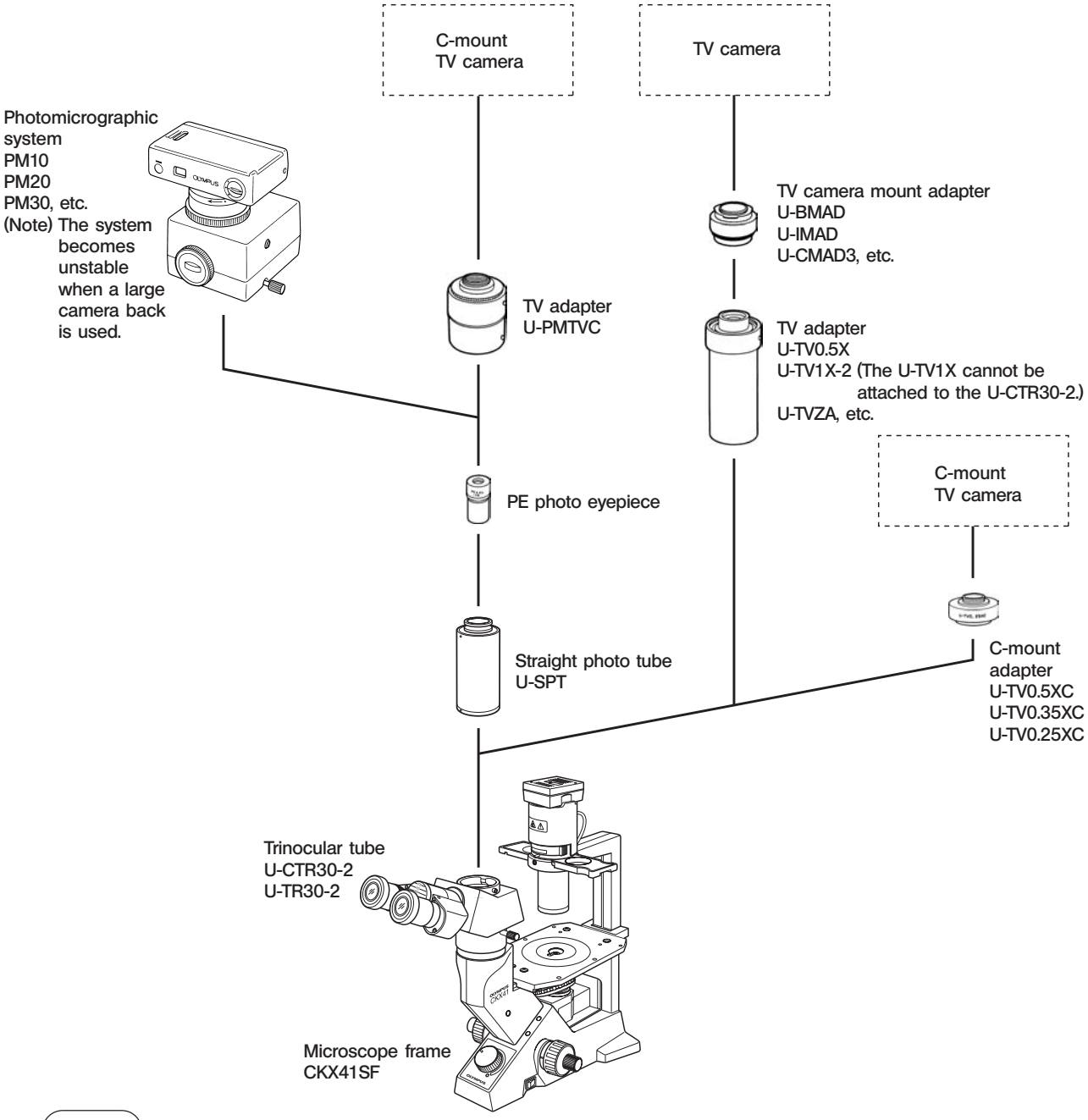
★**Optimum performance cannot be achieved if the light annulus is not properly centered.**

★**Ghost images of the light annulus may sometimes emerge. If this happens, superimposed the brightest light annulus image with the phase annulus.**

★**When a thick specimen is moved or replaced, the light annulus and the phase annulus may deviate. This can reduce image contrast. If this happens, repeat steps 1 to 5 for readjustment.**

★**The centering procedure may have to be repeated in order to get the best possible contrast if a specimen slide or the bottom surface of a culture vessel is not flat. Center the light annulus using objectives in the order of lower to higher magnifications.**

6 PHOTOMICROGRAPHY & TV OBSERVATION



Notes

- Use the 45HA heat absorbing filter when using the PM10, PM20 or PM30 photomicrographic system.
- Pay attention to the size and weight of the TV camera when selecting one to use with this system. Stability and ease of observation can be interfered with by inappropriate cameras.
- Distribute the cables of the photomicrography system or TV camera apart from the lamp socket. Contact with the lamp socket may melt the cable and produces a risk of electric shock. Particularly, the cable of certain photomicrographic systems may come in contact at the front of the viewfinder. Install such a photomicrographic system by slightly rotating it. In this case, however, the framing of the viewfinder does not match that of the finer eyepiece; check image by the viewfinder.
- For focusing and framing in photomicrography, use the viewfinder or finder eyepiece when the U-TR30-2 is used and use the viewfinder when the U-CTR30-2 is used.
- For the color temperature adjustment in photomicrography, the brightness suitable for daylight can be obtained by engaging the LBD filter and setting the light intensity control to the maximum position.

7 TROUBLESHOOTING GUIDE

Under certain conditions, performance of the unit may be adversely affected by factors other than defects. If problems occur, please review the following list and take remedial action as needed. If you cannot solve the problem after checking the entire list, please contact Olympus for assistance.

Trouble	Cause	Remedy	Page
1. Optical System			
a) Although the illumination is on, the field of view is dark.	The socket pin is not connected to the illumination column.	Connect it securely.	26
	The bulb is burned out.	Replace it with a new one.	26
	The light intensity control is set too low.	Set it to the appropriate position.	9
	Too many filters are stacked.	Reduce them to the minimum required number.	29
	The mounted bulb is not the one designated.	Use the designated 6 V, 30 W halogen bulb.	26
b) The edge of the field of view is obscured or not evenly illuminated.	The revolving nosepiece is not correctly engaged.	Make sure that the revolving nosepiece clicks properly into place.	8
	The filter is stopped halfway.	Push it in all the way.	29
	The phase slider is not engaged properly.	Move the slider until it clicks into place.	18
c) Dirt or dust is visible in the field of view.	Dirt/dust on the specimen.	Replace it with a clean specimen.	–
	Dirt/dust on the eyepieces.	Clean them thoroughly.	3
d) The image glares.	The aperture iris diaphragm is stopped down too far.	Open it.	15
e) Visibility is poor. • Image is not sharp. • Contrast is poor. • Details are indistinct. • Phase contrast effect cannot be obtained.	The objective is not correctly engaged in the light path.	Turn the revolving nosepiece until it clicks properly into place.	8
	The aperture iris diaphragm is opened or stopped down too far in brightfield observation.	Adjust the aperture properly.	15
	Correction collar on correction collar equipped objective is not properly adjusted.	While focusing, turn the correction collar to find the best position.	16
	A lens (condenser, objective, eyepiece or culture vessel) is dirty.	Clean it thoroughly.	3
	The bottom of the culture vessel exceeds 2.5 mm in phase contrast observation.	Use a culture vessel with bottom thickness of no more than 2.5 mm.	16
	You are using a brightfield objective.	Use a phase contrast objective.	17
	The light annulus of the condenser does not match the phase annulus of the objective.	Adjust the light annulus so that it matches the phase annulus of the objective.	17
	The light annulus and phase annulus are not centered.	When using the IX2-SL, center them correctly.	19
	The objective in use is not compatible with phase contrast observation.	Use an objective applicable to phase contrast observation.	17
	When the edge of the culture vessel is viewed, the phase annulus and light annulus deviate from one another.	Move the vessel until phase contrast effect is achieved. Also remove the slider and set the aperture iris diaphragm lever to " ⊛".	19

Trouble	Cause	Remedy	Page
f) One side of image is blurred.	The revolving nosepiece is not correctly engaged.	Make sure that the revolving nosepiece clicks properly into place.	8
	The specimen is not correctly mounted on the stage.	Place it correctly on the stage.	10
	The optical performances (profile irregularity, etc.) of the culture vessel bottom plate are poor.	Use a vessel with a good profile irregularity characteristic.	–
2. Electrical System			
a) The bulb flickers and the brightness is unstable.	The line voltage fluctuates.	Use a voltage stabilizer.	–
	The bulb is nearly burned out.	Replace the bulb.	26
	The power cord is not corrected securely.	Correct it securely.	29
3. Focusing			
a) The coarse adjustment knob is too difficult to rotate.	The tension adjustment ring is tightened too much.	Loosen it appropriately.	9
b) The image goes out of focus during observation.	The tension adjustment ring is loosened too much.	Tighten it appropriately.	9
4. Observation Tube			
a) The field of view of one eye does not match that of the other.	Incorrect interpupillary distance adjustment.	Adjust the interpupillary distance.	11
	Incorrect diopter adjustment.	Adjust the diopter.	12
	Your view is not accustomed to microscope observation.	Upon looking into eyepieces, try looking at the overall field before concentrating on the specimen range. You may also find it helpful to look up and into distance for a moment before looking into the microscope again.	–
5. Photomicrography			
a) The image is out of focus.	Poor focusing.	Adjust focusing so that the double crosslines and specimen look clearly defined.	12
b) The image periphery is blurred uniformly.	If you are using an achromatic objective, this type of objective cannot bring edges into sharp focus.	Blurriness is unavoidable.	–
c) Image cannot be focused sharply.	The correction collar is not adjusted.	Adjust the correction collar according to the bottom thickness and material of the vessel.	16
d) The window or fluorescent lamp in the room is photographed.	The stray light entered through the eyepieces or viewfinder is reflected.	Cap both the eyepieces and the photomicrographic system's viewfinder.	–

8 SPECIFICATIONS

Item		Specification	
		CKX31	CKX41
1. Optical system		UIS2/UIS (Universal Infinity System) optical system	
2. Illumination		Built-in transmitted Koehler illumination High-intensity halogen bulb 6V30WHAL (PHILIPS 5761) (Average life time: Approx. 100 hr. when used as directed) Output rating: 6 V ⎓ 30 VA (DC) Input rating: 100-120/220-240 V ∿ , 0.85/0.45 A, 50/60 Hz	
3. Focusing mechanism		Vertical movement of revolving nosepiece (stage height fixed) Coarse and fine adjustment knobs (provided with rotation tension adjustment mechanism) Stroke per rotation (from focal point on stage surface): 7 mm upward and 2 mm downward	
4. Revolving nosepiece		Quadruple positions (fixed)	
5. Observation tube Applicable eyepieces • WHB10X (U-CBI30-2, U-CTR30-2, CKX-TBI) • WH10X/WH15X (U-BI30-2, U-TR30-2)	Binocular	Binocular tube (fixed): Tilting angle 45° Interpupillary distance adjustment 48 to 75 mm Field number 20	Binocular tube U-CBI30-2: Tilting angle 30° Interpupillary distance adjustment 48 to 75 mm Field number 20
			Binocular tube U-BI30-2: Tilting angle 30° Interpupillary distance adjustment 50 to 76 mm Field number 22
	Trinocular		Trinocular tube U-CTR30-2: Tilting angle 30° Interpupillary distance adjustment 48 to 75 mm Field number 20
			Trinocular tube U-TR30-2: Tilting angle 30° Interpupillary distance adjustment 50 to 76 mm Field number 22
	Tilting binocular		Tilting binocular tube U-CTBI Tilting angle 30 to 60° Interpupillary distant adjustment 48 to 75 mm Field number 18 (built-in 10X eyepieces)
			Tilting binocular tube CKX-TBI Tilting angle 30 to 60° Interpupillary distance adjustment 50 to 76 mm Field number 20 (available only with WHB10X)
6. Eyepiece		10X, field number 20 (fixed)	WHB10X: Field number 20 WHN10X: Field number 22

Item		Specification	
		CKX31	CKX41
7. UIS2 Objectives (UIS series objectives can also be used.)	Brightfield	PlanCN4X N.A. 0.10, W.D. 18.5 mm, resolution 3.36 µm PlanCN10X N.A. 0.25, W.D. 10.5 mm, resolution 1.30 µm PlanCN20X N.A. 0.40, W.D. 1.2 mm, resolution 0.84 µm PlanCN40X N.A. 0.65, W.D. 0.6 mm, resolution 0.54 µm PlanCN60X N.A. 0.80, W.D. 0.2 mm, resolution 0.42 µm PlanCN100XO N.A. 1.25, W.D. 0.13 mm, resolution 0.27 µm LUCPlanFLN20X N.A. 0.45, W.D. 6.6-7.8 mm, resolution 0.75 µm LUCPlanFLN40X N.A. 0.60, W.D. 2.7-4.0 mm, resolution 0.56 µm LUCPlanFLN60X N.A. 0.70, W.D. 1.5-2.2 mm, resolution 0.48 µm	
	Phase contrast (PhP is for IX2-SLP only)	UPlanFLN4XPh (PhP) N.A. 0.13, W.D. 17.0 (16.4) mm, resolution 2.60 µm CAchN10X (PhP) N.A. 0.25, W.D. 8.8 mm, resolution 1.30 µm CPlanN10XPh N.A. 0.25, W.D. 10.0 mm, resolution 1.30 µm PlanN10XPh N.A. 0.25, W.D. 10.6 mm, resolution 1.30 µm LCAchN10XPh (PhP) N.A. 0.40, W.D. 3.2 mm, resolution 0.84 µm LUCPlanFLN20XPh N.A. 0.45, W.D. 6.6-7.8 mm, resolution 0.75 µm LCAchN40XPh (PhP) N.A. 0.55, W.D. 2.2 mm, resolution 0.61 µm	
8. Stage		Dimensions: 160(W) x 250(D) mm Stage extension plate dimensions: 70(W) x 180(D) mm Provided with ϕ35 mm petri dish holder (CKX31 only)	
9. Mechanical stage CK40-MVR		Traverse area: 120(X) x 78(Y) mm Coaxial low drive control knobs on right or left side of plain stage. Provided with three culture vessel holders.	
10. Condenser		Ultralong working distance condenser, N.A. 0.3, W.D. 72 mm. Detachable.	
11. Dimensions & weight		236(W) x 469(D) x 476(H) mm, 8 kg	236(W) x 371(D) x 476(H) mm, 8.8 kg
12. Operating environment		• Indoor use. • Altitude: Max. 2000 m • Ambient temperature: 5° to 40°C (41° to 104°F) • Maximum relative humidity: 80% for temperatures up to 31°C (88°F), decreasing linearly through 70% at 34°C (93°F), 60% at 37°C (99°F), to 50% relative humidity at 40°C (104°F). • Supply voltage fluctuations; Not to exceed ±10% of the normal voltage. • Pollution degree: 2 (in accordance with IEC60664) • Installation/Overvoltage category: II (in accordance with IEC60664)	

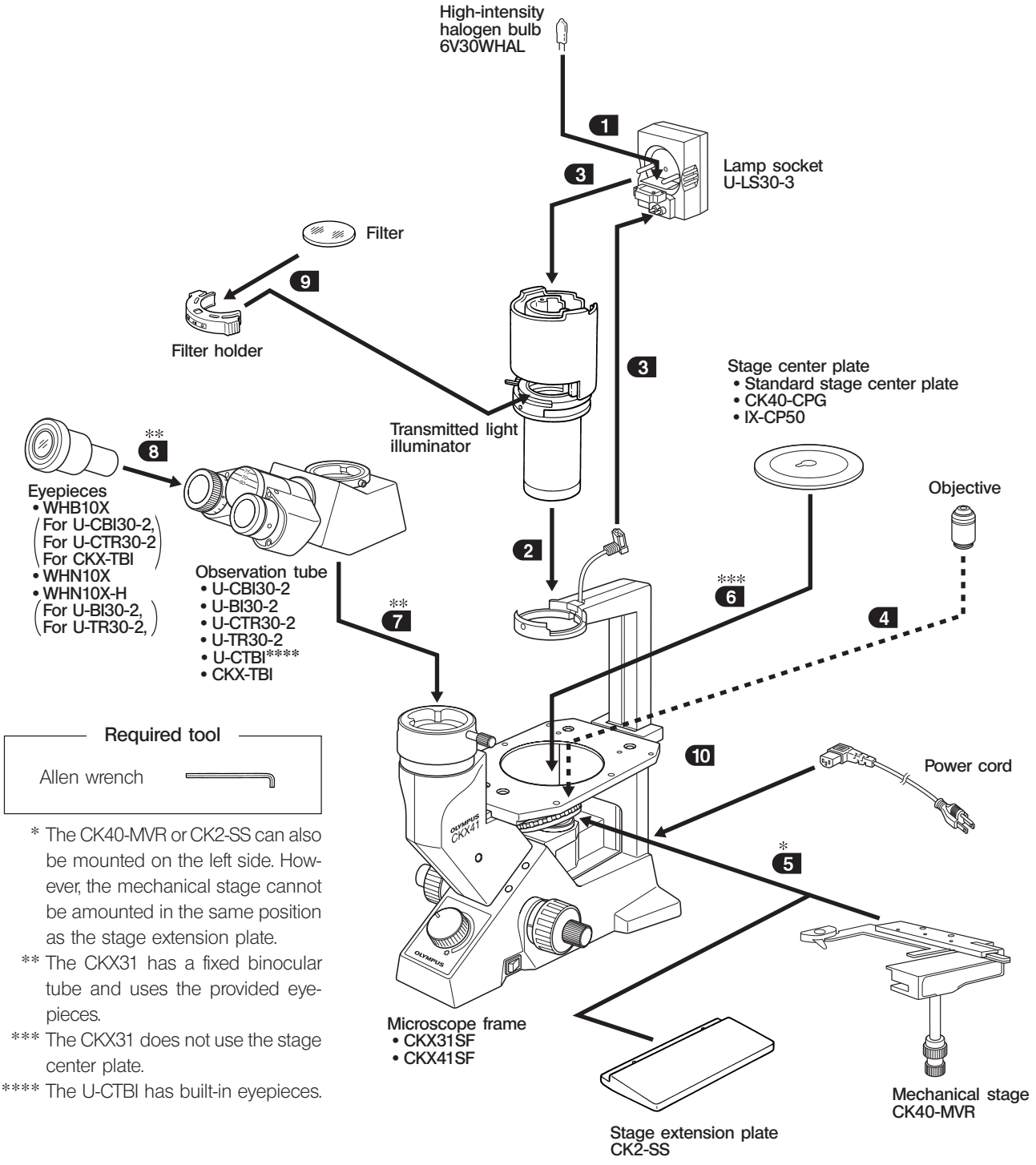
9 ASSEMBLY

9-1 Assembly Diagram

The diagram below shows the sequence of assembly of the various modules. The numbers indicate the order of assembly.

★ When assembling the microscope, make sure that all parts are free of dust and dirt, and avoid scratching any parts or touching glass surfaces.

★ Keep the provided Allen wrench on hand. You will need it when replacing the modules.



Required tool

Allen wrench

* The CK40-MVR or CK2-SS can also be mounted on the left side. However, the mechanical stage cannot be amounted in the same position as the stage extension plate.

** The CKX31 has a fixed binocular tube and uses the provided eyepieces.

*** The CKX31 does not use the stage center plate.

**** The U-CTBI has built-in eyepieces.

9-2 Detailed Assembly Procedures

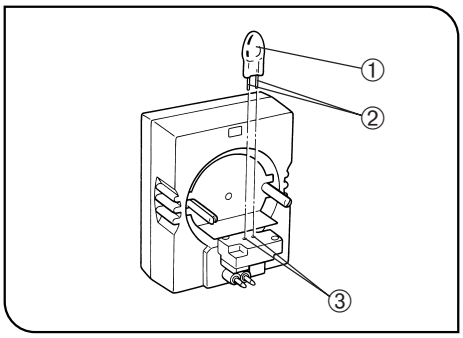


Fig. 25

1 Installing/Replacing the Halogen Bulb (Fig. 25)

◎Use only the designated high-intensity halogen bulb 6V30WHAL (PHILIPS 5761).

⚠To prevent reduced bulb life or cracking, do not touch the bulb with bare hands. If fingerprints are accidentally left on the bulb, wipe the bulb with a soft cloth.

• Holding the bulb ① with gloves or a piece of gauze, insert the bulb pins ② fully into the pin holes ③ on the lamp socket.

★Insert the bulb gently. Squeezing too hard will damage the bulb.

⚠Caution for Bulb Replacement During Use or Right After Use

The bulb, lamp socket and areas near these will be extremely hot during and right after use.

Set the main switch to "○" (OFF), disconnect the power cord from the wall outlet, then allow the old bulb and lamp socket to cool before replacing the bulb with a new of the designated type.

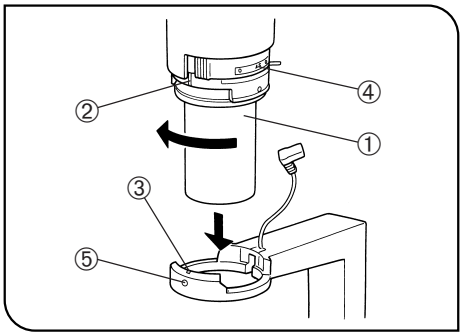


Fig. 26

2 Installing the Transmitted Light Illuminator (Fig. 26)

1. While aligning the index groove ② on the transmitted light illuminator ① with the notch ③ on the illumination column, insert the transmitted light illuminator ① gently into the illumination column.
2. Rotate the transmitted light illuminator ① 90° clockwise so that letters "AS" ④ on the filter holder faces directly the front. Then tighten the clamping screw ⑤ using the Allen wrench provided with the microscope frame.

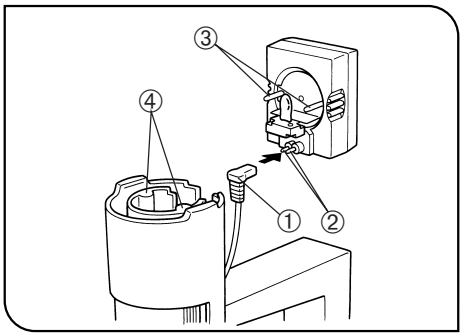


Fig. 27

3 Installing the Lamp Socket (Fig. 27)

• Connect the plug ① to the socket pin ②. The, while aligning the guide pins ③ with the condenser's guide holes ④, push the lamp socket gently into the transmitted light illuminator.

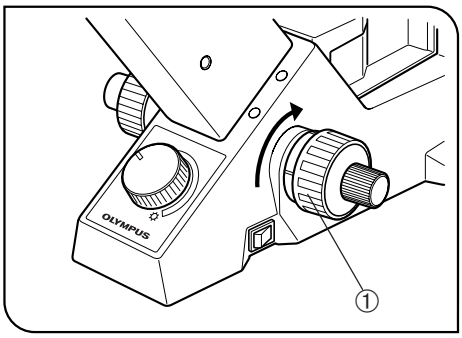


Fig. 28

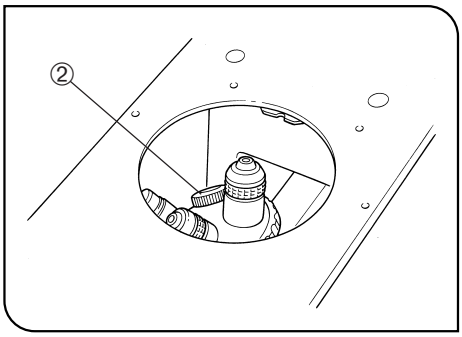


Fig. 29

4 Mounting the Objectives (Figs. 28 & 29)

★ **First raise the revolving nosepiece slightly to remove the transportation pad on the nosepiece's base.**

◎Keep the transportation pad in a safe place. You will need it when the equipment is sent for repair or transported to another location.

1. Turn the coarse adjustment knob ① towards the back until the revolving nosepiece is set at its lower limit. (Fig. 28)
2. Screw the objective with the lowest magnification into the revolving nosepiece from the left side of the microscope. Then turn the nosepiece clockwise and mount the remaining objectives in order of magnification — from low to high.

◎Mounting the objectives this way makes it easier to change magnification.

◎With the CKX41, the objectives can be mounted through the opening on the stage.

★ **Clean the objectives periodically. The objective tips on a culture microscope are susceptible to dust.**

★ **Be sure to cover any unused threaded positions with the objective caps ② to prevent dirt and dust from getting inside. (Fig. 29)**

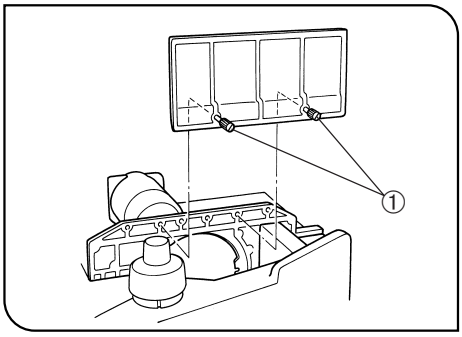


Fig. 30

5 Mounting the Stage Extension Plate/Mechanical Stage (Fig. 30)

◎The stage extension plate can be mounted on the left or right side of the stage to expand the stage surface. However, the stage extension plate and mechanical plate cannot be used simultaneously on the same side.

Attaching the CK2-SS Stage Extension Plate

Screw the clamping screws ① into the stage extension plate and then into the plain stage from above on the right side or from below on the left side. Tighten them with a coin or similar tool until the plate is securely attached.

Attaching the CK40-MVR Mechanical Stage

◎This can be attached on either the left or right side of the stage. Attach in the same way as the stage extension plate.

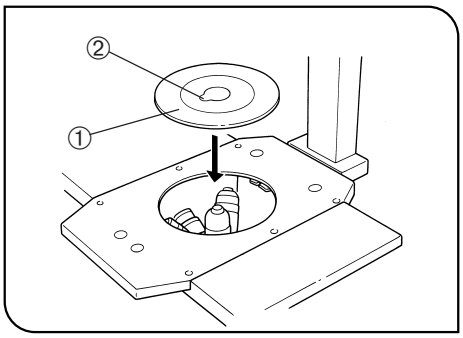


Fig. 31

6 Mounting the Stage Center Plate (CKX41 Only) (Fig. 31)

Fit the standard stage center plate ① into the opening on the stage.

◎Turn the center plate so that the notch ② faces to the front for easy confirmation of the objective tip.

★**When using the glass stage center plate, set it in the direction so that its product code engraving (CK40-CPG) can be read from the front.**

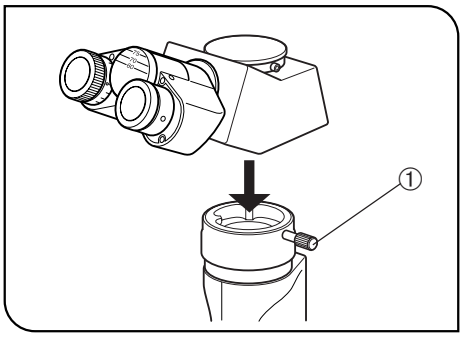


Fig. 32

7 Mounting the Observation Tube (CKX41 Only) (Fig. 32)

1. Loosen the observation tube clamping knob ① to a degree at which the knob does not come out. (Fig. 32)
2. Fit the circular dovetail at the bottom of the observation tube into the observation mount on the microscope frame. Adjust the observation tube until the binocular eyepieces face directly to the front, and then tighten the clamping knob. (Fig. 32)

★**Mount the CKX-TBI tilting observation tube as instructed on the tag provided with the observation tube.**

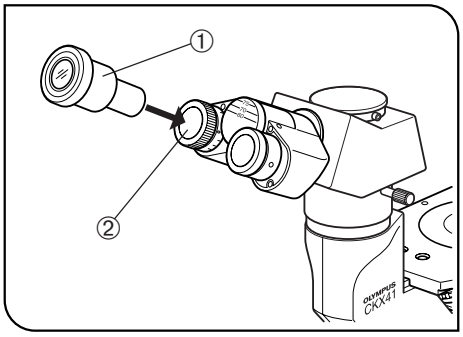


Fig. 33

8 Mounting the Eyepieces (Fig. 33)

Insert the eyepiece ① into each eyepiece sleeve ② on the observation tube.

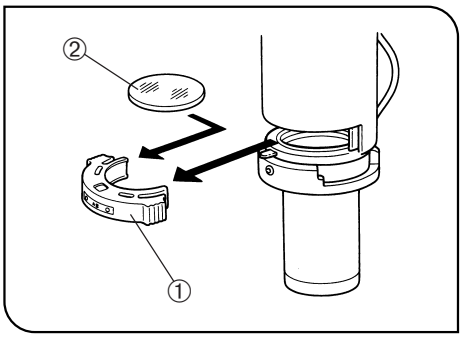


Fig. 34

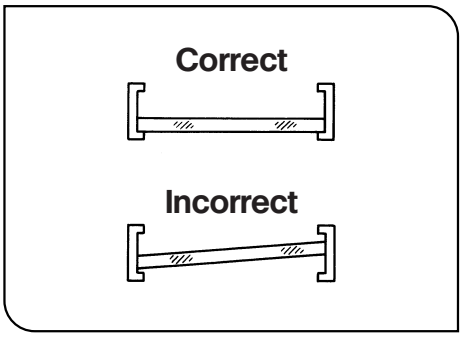


Fig. 35

9 Mounting the Filters (Figs. 34 & 35)

⚠Let the filters cool down sufficiently before replacing them. Take out the filter holder ① and insert the required filters ②.

★Push the filter down to the bottom as shown in Fig. 35 so that it does not tilt. If the filter is inclined or is not pushed down to the bottom, it may fall off the filter holder.

◎More than one filter can be stacked in the filter holder. You can mount as many as you like, as long as the total thickness does not exceed 11 mm.

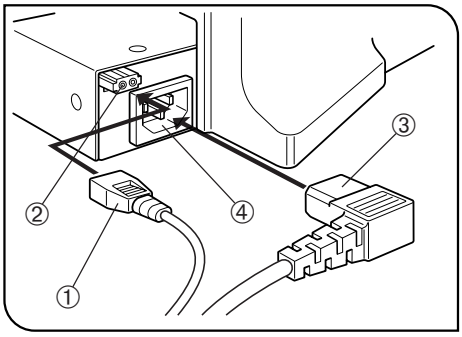


Fig. 36

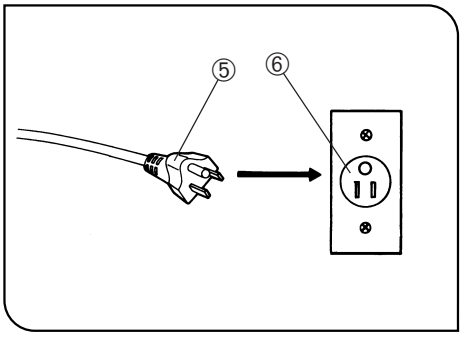


Fig. 37

10 Connecting the Cables and Power Cord (Figs. 36 & 37)

⚠Cables and cords are vulnerable when bent or twisted. Never subject them to excessive force.

⚠Make sure that the main switch of the power supply is set to "○" (OFF) before connecting cables.

1. Connect the plug ① of the illumination column firmly to connector ② on the rear of the microscope.

⚠Do not connect anything other than the plug ① of the cord from the illumination column to connector ②. Doing so will cause equipment failure.

⚠Always use the AC power adapter and power cord provided by Olympus. If no power cord is provided, please select the proper power cord by referring to the section "PROPER SELECTION OF THE POWER SUPPLY CORD" at the end of this instruction manual.

2. Connect the power cord connector ③ to connector ④ firmly. (Fig. 36)
3. Connect the power cord plug ⑤ to a wall outlet ⑥. (Fig. 37)

⚠Be sure to supply power from a grounded, 3-conductor power outlet using the proper power cord. If the power outlet is not grounded properly, Olympus can no longer warrant the electrical safety performance of the equipment.

⚠If the power cord or a connection cable comes in contact with the lamp socket or surrounding equipment, the cord or cable may melt and result in shock hazard. To prevent this, distribute the cords and cables apart from the lamp socket.

PROPER SELECTION OF THE POWER SUPPLY CORD

If no power supply cord is provided, please select the proper power supply cord for the equipment by referring to " Specifications " and " Certified Cord " below:

CAUTION: In case you use a non-approved power supply cord for Olympus products, Olympus can no longer warrant the electrical safety of the equipment.

Specifications

Voltage Rating	125V AC (for 100-120V AC area) or, 250V AC (for 220-240V AC area)
Current Rating	6A minimum
Temperature Rating	60°C minimum
Length	3.05 m maximum
Fittings Configuration	Grounding type attachment plug cap. Opposite terminates in molded-on IEC configuration appliance coupling.

Table 1 Certified Cord

A power supply cord should be certified by one of the agencies listed in Table 1 , or comprised of cordage marked with an agency marking per Table 1 or marked per Table 2. The fittings are to be marked with at least one of agencies listed in Table 1. In case you are unable to buy locally in your country the power supply cord which is approved by one of the agencies mentioned in Table 1, please use replacements approved by any other equivalent and authorized agencies in your country.

Country	Agency	Certification Mark	Country	Agency	Certification Mark
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	JET, JQA, TÜV, UL-APEX / MITI	
Austria	ÖVE		Netherlands	KEMA	
Belgium	CEBEC		Norway	NEMKO	
Canada	CSA		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA BSI	
Germany	VDE		U.S.A.	UL	
Ireland	NSAI				

Table 2 HAR Flexible Cord

APPROVAL ORGANIZATIONS AND CORDAGE HARMONIZATION MARKING METHODS

Approval Organization	Printed or Embossed Harmonization Marking (May be located on jacket or insulation of internal wiring)		Alternative Marking Utilizing Black-Red-Yellow Thread (Length of color section in mm)		
			Black	Red	Yellow
Comite Electrotechnique Belge (CEBEC)	CEBEC	‹HAR›	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prüfstelle	‹VDE›	‹HAR›	30	10	10
Union Technique de l´Electricite´ (UTE)	USE	‹HAR›	30	10	30
Instituto Italiano del Marchio di Qualita´ (IMQ)	IEMMEQU	‹HAR›	10	30	50
British Approvals Service for Electric Cables (BASEC)	BASEC	‹HAR›	10	10	30
N.V. KEMA	KEMA-KEUR	‹HAR›	10	30	30
SEMKO AB Svenska Elektriska Materielkontrollanstalter	SEMKO	‹HAR›	10	10	50
Österreichischer Verband für Elektrotechnik (ÖVE)	‹ÖVE›	‹HAR›	30	10	50
Danmarks Elektriske Materialkontroll (DEMKO)	‹DEMKO›	‹HAR›	30	10	30
National Standards Authority of Ireland (NSAI)	‹NSAI›	‹HAR›	30	30	50
Norges Elektriske Materiellkontroll (NEMKO)	NEMKO	‹HAR›	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	‹UNED›	‹HAR›	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	‹HAR›	30	30	70
Instituto Portages da Qualidade (IPQ)	np	‹HAR›	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	‹HAR›	10	30	90
Elektriska Inspektoratet	SETI	‹HAR›	10	30	90

Underwriters Laboratories Inc. (UL)	SV, SVT, SJ or SJT, 3 X 18AWG
Canadian Standards Association (CSA)	SV, SVT, SJ or SJT, 3 X 18AWG

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